

CLAIMS:

1. A substrate for electronic devices comprising: a substrate consisting of silicon and having a film-forming surface, and a first buffer layer, a second buffer layer, a first oxide electrode layer and a second oxide electrode layer, which are grown epitaxially and laminated in this order on the film-forming surface of the substrate, wherein
 - said first buffer layer is a first metal oxide having a fluorite structure,
 - said second buffer layer is a second metal oxide having a fluorite structure,
 - said first oxide electrode layer is a third metal oxide having a layered perovskite structure, and
 - said second oxide electrode layer is a fourth metal oxide having a simple perovskite structure.
2. A substrate for electronic devices according to claim 1, wherein the orientation of said film-forming surface is (100), (110), or (111).
3. A substrate for electronic devices according to claim 1, wherein in said film-forming surface, a diffraction pattern is not observed in a diffraction image by a RHEED method, before forming said first buffer layer.
4. A substrate for electronic devices according to claim 1, wherein said first metal oxide is a solid solution expressed as $Zr_{1-x}M\alpha_xO_y$ ($0 < x < 1$, $1.5 < y < 2$) obtained by substituting a part of Zr, being a constituent element of zirconia, by a metal element $M\alpha$, where $M\alpha$ indicates one kind of element selected from La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, Mg, Ca, Sr and Ba, and the first metal oxide is cubically

oriented in the (100) direction.

5. A substrate for electronic devices according to claim 1, wherein said second metal oxide is cerium oxide or a solid solution expressed as $Ce_{1-x}M\beta_xO_y$ ($0 < x < 1$, $1.5 < y < 2$) obtained by substituting a part of Ce, being a constituent element of cerium oxide, by a metal element $M\beta$, where $M\beta$ indicates one kind of element selected from Zr, La, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, Mg, Ca, Sr and Ba, and the second metal oxide is cubically oriented in the (100) direction.

6. A substrate for electronic devices according to claim 1, wherein said third metal oxide is a solid solution containing a metal element $M\gamma$ or RE as a constituent element, and expressed as $M\gamma RuO_4$, RE_2NiO_4 , or $REBa_2Cu_3O_x$, where $M\gamma$ indicates one kind of element selected from Ca, Sr and Ba, and RE indicates one kind of element selected from La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y, and the third metal oxide is tetragonally or orthorhombically oriented in the (001) direction.

7. A substrate for electronic devices according to claim 1, wherein said fourth metal oxide is a solid solution containing a metal element $M\gamma$ or RE as a constituent element, and expressed as $M\gamma RuO_3$, $(RE, M\gamma)CrO_3$, $(RE, M\gamma)MnO_3$, $(RE, M\gamma)CoO_3$, or $(RE, M\gamma)NiO_3$, where $M\gamma$ indicates one kind of element selected from Ca, Sr and Ba, and RE indicates one kind of element selected from La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y, and the third metal oxide is cubically or pseudo-cubically oriented in the (100) direction.

8. A manufacturing method for a substrate for electronic devices comprising:

a pretreatment step for washing a substrate consisting of silicon and having a film-forming surface;

a first film-forming step in which the substrate having been subjected to said pretreatment step is arranged in a film-forming container under a reduced-pressure atmosphere, and a predetermined gas or plasma is irradiated onto the film-forming surface of said substrate, to epitaxially grow a first buffer layer comprising a first metal oxide having a fluorite structure;

a second film-forming step in which a predetermined gas or plasma is irradiated onto the surface of said first buffer layer, to epitaxially grow a second buffer layer comprising a second metal oxide having a fluorite structure;

a third film-forming step in which a predetermined gas or plasma is irradiated onto the surface of said second buffer layer, to epitaxially grow a first oxide electrode layer comprising a third metal oxide having a layered perovskite structure; and

a fourth film-forming step in which a predetermined gas or plasma is irradiated onto the surface of said first oxide electrode layer, to epitaxially grow a second oxide electrode layer comprising a fourth metal oxide having a simple perovskite structure.

9. A manufacturing method for a substrate for electronic devices according to claim 8, wherein in said first film-forming step, a gas or plasma of a constituent element of said first buffer layer is irradiated onto the film-forming surface of said substrate held under a temperature, a back pressure and an oxygen partial pressure such that the vapor pressure of SiO does not reach the saturated vapor pressure.

10. A manufacturing method for a substrate for electronic devices according to claim 9, wherein in said first film-forming step, an SiO₂ film forming an oxide layer existing on the

film-forming surface of said substrate is reduced to Si, and a first metal oxide layer constituting said first buffer layer is deposited, while sublimating and removing the Si formed by reduction as SiO.

11. A manufacturing method for a substrate for electronic devices according to claim 9, wherein in said first film-forming step, when forming said first buffer layer, the temperature of said substrate is 800°C or higher, the back pressure in said film-forming atmosphere is not lower than 1×10^{-6} Torr, and the oxygen partial pressure in said film-forming atmosphere is not lower than 5×10^{-6} Torr.

12. A manufacturing method for a substrate for electronic devices according to claim 11, wherein in said first film-forming step, when forming said first buffer layer, the temperature of said substrate is from 600°C to 800°C inclusive, the back pressure in the film-forming atmosphere is from 1×10^{-6} Torr to 5×10^{-6} Torr inclusive, and the oxygen partial pressure in said film-forming atmosphere is from 5×10^{-6} Torr to 5×10^{-4} Torr inclusive.

13. A manufacturing method for a substrate for electronic devices according to claim 9, wherein in said first film-forming step, said first buffer layer is formed at a deposition rate not lower than a growth rate of a thermally oxidized SiO₂ film on the film-forming surface of said substrate.

14. A manufacturing method for a substrate for electronic devices according to claim 13, wherein in said first film-forming step, said first buffer layer is epitaxially grown on said film-forming surface after removing said SiO₂ film, without forming a thermally oxidized

SiO₂ film.

15. A manufacturing method for a substrate for electronic devices according to claim 13, wherein in said first film-forming step, the deposition rate of said first buffer layer is not lower than 0.2 nm/min.

16. A manufacturing method for a substrate for electronic devices according to claim 8, wherein said predetermined gases or plasmas comprise elements constituting metal oxides to be formed in each step of said first film-forming step, said second film-forming step, said third film-forming step and said fourth film-forming step.

17. A manufacturing method for a substrate for electronic devices according to claim 8, wherein said predetermined gas or plasma is generated by irradiating a laser beam onto a base metal arranged opposite to the film-forming surface of said substrate.

18. A manufacturing method for a substrate for electronic devices according to claim 8, wherein in said pretreatment step, the film-forming surface of said substrate is finished as a surface where an oxide layer exists, not as a reconstructed surface or a hydrogen-terminated surface.

19. An electronic device which is a functional element comprising a substrate for electronic devices according to any one of claim 1 through claim 7.

20. An electronic device according to claim 19, wherein said functional element is a capacitor.

21. An electronic device according to claim 19, wherein said functional element is a ferroelectric element.
22. An electronic device according to claim 19, wherein said functional element is a cantilever.
23. An electronic device according to claim 19, wherein said functional element is a piezoelectric element.